

This skills unit contains:

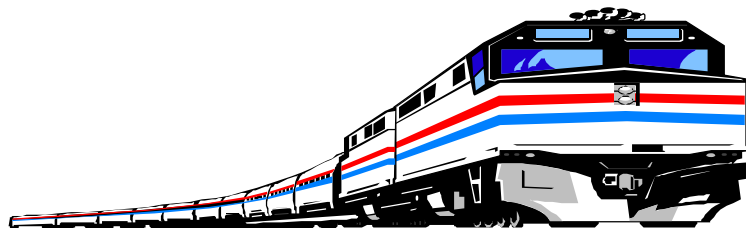
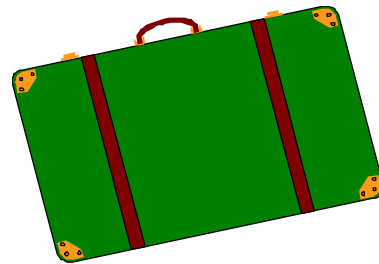
- measurement for every day
- converting measures
- 12 and 24 hour time

Measurement for every day

In many everyday activities you take measurements, sometimes using instruments like measuring tapes and jugs.

You often use your experience and estimating skills to make decisions:

- is it safe to cross the road?
- is it cold enough to wear a coat?
- is that case too heavy to carry?
- what is the size of the ball bearing in the front wheel of that bike?
- is that truck full of soil too heavy for the driveway?
- what time does the train leave?



Some decisions need accurate measurement; for some you use your own judgement.

**Activity 1**

Think of 4 measurements or judgments you will probably make today:

1 _____

2 _____

3 _____

4 _____

Activity 1 Answers

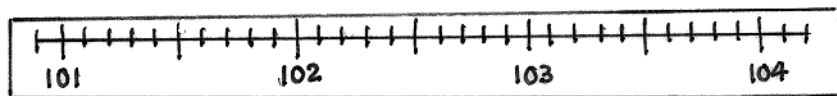
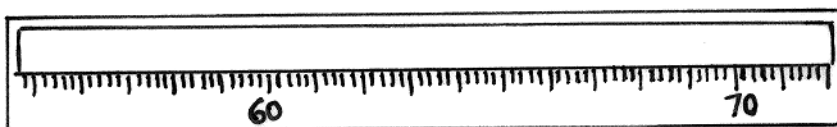
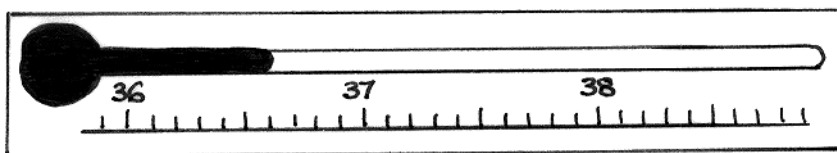
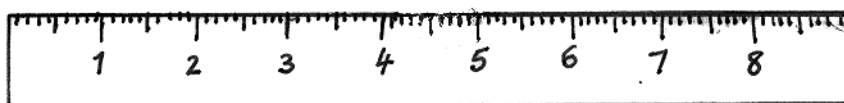
There are many possible answers; all are decisions you make every day eg. the amount of milk you need to buy.

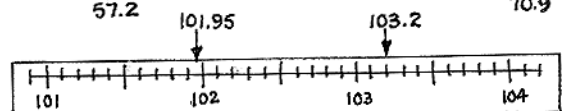
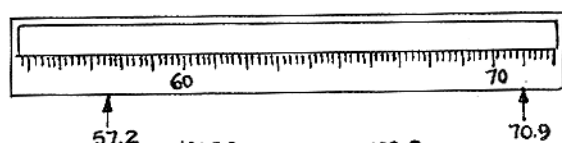
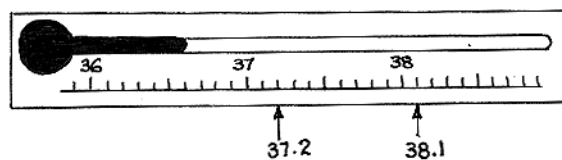
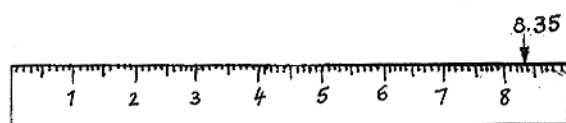
To take accurate measurements every day, you can use measuring instruments like tapes, scales or measuring jugs. You may need to adjust to different scales and often use decimal values to read from these instruments.

**Activity 2**

On the scales given below, mark these measurements:

37.2, 8.35, 103.2, 57.5, 70.9, 101.95 38.1



Activity 2 Answers



*Now look at the main units
in the metric system you use
every day.*

Length:



Length tells you **how long**, **how far**, **how thick** or **how wide** something is.

The common unit of length is the **metre (m)** but the **kilometre (km)** and the **millimetre (mm)** are also used.

Examples:

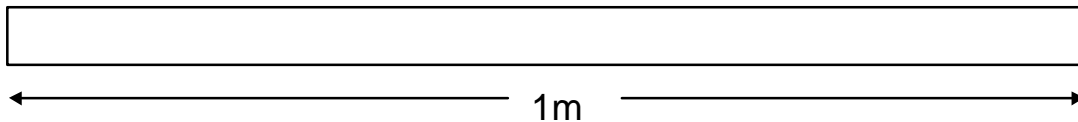
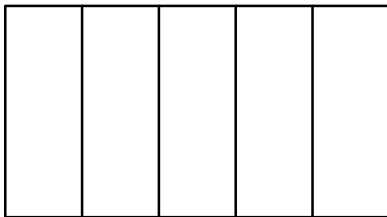
- the distance from Brisbane to Sydney is measured in kilometres(km).
- curtain material is measured in metres (m).
- the diameters of drill bits are measured in millimetres (mm).

Try this activity to get an idea of the length of 1 metre.



Activity 3

- 1 Cut 5 strips, each the width of an A4 sheet of paper. Glue them together (with an overlap about the width of a small finger). The piece you get will be about one metre long.



- 2 Use a tape measure to mark out a length of 1 metre (1 m). Now estimate by eye, then measure, each of these lengths:

Object	Estimate	Measure
a) the width of a doorway	_____	_____
b) the length of a table	_____	_____
c) your height	_____	_____
d) the lengths of two more things you can see	_____	_____
	_____	_____

Activity 3 Answers

- 1 no answer required
- 2 possible answers only, depend on objects measured
 - Estimate Measure
 - a) 80 cm
 - b) 1 m 40 cm
 - c) depends on your height
 - d) depends on items you choose

Try to reconsider your idea of one metre.



Activity 4

- 1 Measure the average length of your stride (large step). Take 10 paces, then measure the length.
 - a) Estimate, by eye, the width of a block of land.
 - b) Now pace out the width of the block. Compare your estimate and the measurement obtained by pacing.
- 2 Place heel against toe (see the picture below) to count the number of shoe lengths as you “walk” a measured distance.

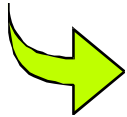


- a) Estimate a short distance.
- b) Measure the same distance with the heel to toe method.
- c) Measure the same distance by pacing it out.
- d) Did your answers change?
- e) Which of the three measures is the most accurate?

Activity 4 Answers

Your answers will depend on the size of the block of land and the distance you choose.

In the last activity you used a pace and a shoe length as measuring instruments. These lengths are not standards as they vary from person to person.



Measuring instruments must be **reliable** and **able to be reproduced**.

Many measurements like:

- the sizes of shoes;
 - the diameters of nuts and bolts;
 - spanner sizes;
 - bread and beer ingredients;
- must not depend on where or when they were made.

Standard measurements are needed in most measuring situations.

Mass



Mass refers to the **amount of matter in an object** or thing. The weight of the object depends on its mass.

The common unit of mass is the **kilogram (kg)** but the **gram (g)** is also used.

Examples:

- 200 sheets of photocopy paper have a mass of 1 kg.
- Sugar and flour can be bought in 1 kg bags.

**Activity 5**

Try to estimate masses of 1 kg:

- 1 a) Hold a one litre carton of milk in one hand - this is a mass of 1 kg.
b) Now repeat (a) with
 - 1 kg of sugar.
 - 1 kg of rice.
 - a 1 kg weight from a sports store or balance scales.
- 2 a) Now select some common items,
 - a 2 litre container of milk
 - half a bucket of water

Estimate their masses in kilograms.

- b) Use kitchen or bathroom scales to check the masses you have just estimated.
- c) When buying fruit in a supermarket, use the scales supplied to check your estimates of mass.

Activity 5 Answers

- 1 no answers required
- 2 answers depend on the items chosen

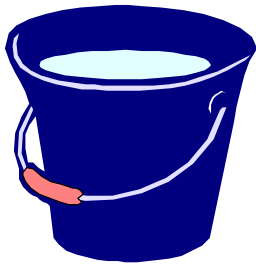
Capacity



A container can hold liquid, so it is said to have a **capacity** to hold liquid.

The common unit of capacity is the **litre (L)** and the **millilitre (mL)** is also used.

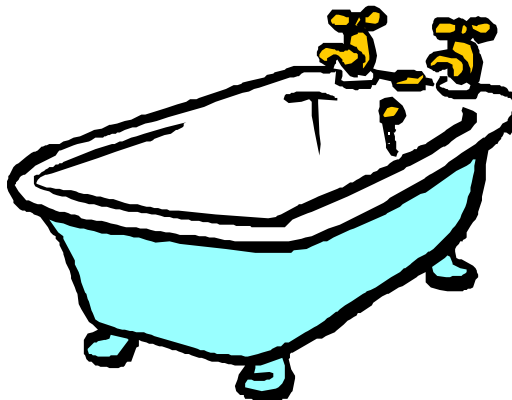
You buy milk in 1 litre cartons - this is a useful measure for comparison.



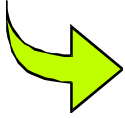
Measuring jugs usually hold 2 litres.
A standard bucket usually holds 10 litres.

Estimate the capacity of:

- a bath which is half filled with water
- the petrol tank of a car
- a kitchen sink.

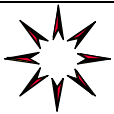


Time



Time is a measure of **how long something takes**.

The common unit of time is the **second (s)** but other units you also use are **minutes, hours, days** and **years**.



Activity 6

How good are you at estimating seconds?

- 1 Count to twenty by saying, at normal speech speed, “one thousand and one, one thousand and two, one thousand and three, , one thousand and twenty”.
You have just counted twenty seconds!
- 2 Compare this count with 20 seconds measured by a watch.
- 3 Repeat the count and reduce or increase your speed of speech so that your count is closer to the 20 seconds measured on a watch. When you get there you will have reached the counting speed for seconds. Well done!
- 4 Estimate how long (in seconds) each normal breath takes.
- 5 Estimate how many beats of the human “pulse” (at your wrist) there are in 10 seconds.

Activity 6 Answers

- | | | | |
|---|--------------------|---|-----------------|
| 1 | no answer required | 4 | about 4 seconds |
| 2 | no answer required | 5 | about 12 beats |
| 3 | no answer required | | |

Temperature



Temperature is a measure of **how hot something is**.

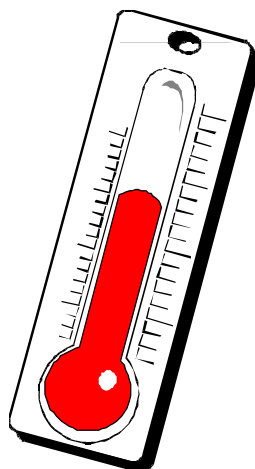
The common unit of temperature is the **degree Celsius ($^{\circ}\text{C}$)**.

A **thermometer** is used to measure temperature. On a thermometer there are 100 equal degree divisions between the freezing point of water (0°C) and boiling point of water (100°C).

Some common temperatures are:

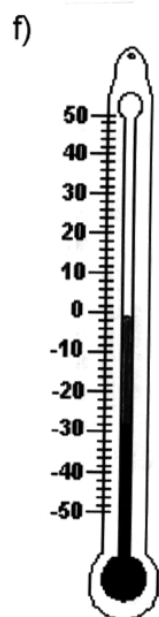
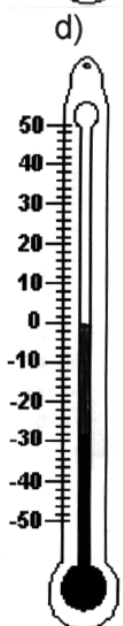
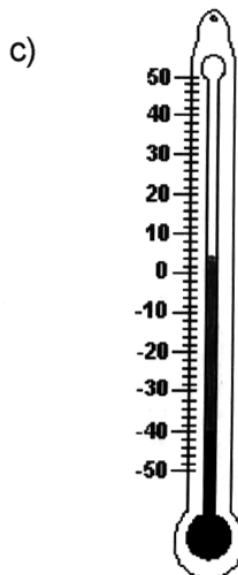
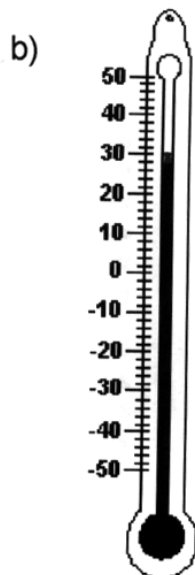
-5°C	5° below freezing, very cold
5°C	cold
15°C	cool
20°C	mild
30°C	hot
36.9°C	human body temperature (skin temperature is about 30°C)
140°C	slow
180°C	moderate
230°C	hot

} oven temperatures



**Activity 7**

Read the temperatures shown on the thermometers:

**Activity 7 Answers**

a) 18°C

b) 30°C

c) 5°C

d) 0°C

e) -10°C

f) -1°C

Sometimes the common units of measurement are too large or too small for practical measurements.

When measuring distances (length) from Sydney to Melbourne, it is better to use the kilometre (km) and not the metre. For smaller lengths, such as the diameter of a bolt, use the millimetre (mm).

The most used **conversions of metric units** are:

kilo (symbol k) meaning 1000

eg. 1 kilometre (1 km) = 1000 m

milli (symbol m) meaning $\frac{1}{1000}$

eg. 1 millimetre (1 mm) = $\frac{1}{1000}$ m

centi (symbol c) meaning $\frac{1}{100}$

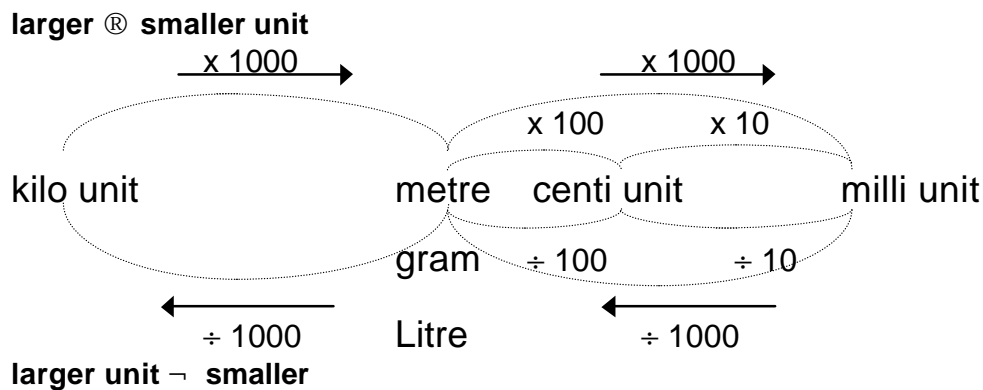
eg. 1 centimetre (1 cm) = $\frac{1}{100}$ m



Converting measures:

If changing from a **larger unit** to a **smaller one** we **multiply** by the conversion factor.

If changing from a **smaller unit** to a **larger one** we **divide** by the conversion factor.



Now look more closely at the conversion of metric units.

Length

In addition to the common unit, the metre, other metric units of length are:

- **the millimetre (mm); 1000 mm = 1 m**
 - * a five cent coin is about 1 mm thick, or
 - * a stack of 10 sheets of photocopy paper is also about 1 mm thick
- **the centimetre (cm); 100 cm = 1 m**
 - * the nail on the “little” finger of an adult is about 1cm wide
- **the kilometre (km); 1 km = 1000 m**

A rough measure of 1 kilometre is the distance travelled when you:

- * walk briskly for 10 to 12 minutes, or
- * drive for one minute at about 60 km/hr, or
- * cycle for about 4 minutes.

Examples of using the conversion factors:

- 1 200 mm = (200 ÷ **1000**) m = 0.2 m
- 2 1.5 km = (1.5 x **1000**) m = 1 500 m
- 3 15.6 cm = (15.6 x **10**) mm = 156 mm

For more work on converting measures, see the **Calculation B** skills unit.

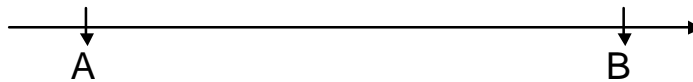


Activity 8

1 **Estimate, then measure** with a tape or ruler:

- a) the width of the palm of your hand
- b) your hand span

2



a) **Estimate** the length of the interval AB in:

centimetres _____

millimetres _____

b) Now **measure** the length of interval AB in:

centimetres _____ (to the nearest cm)

millimetres _____ (to the nearest mm)

c) How did your estimate and measurement compare?

3 You might like to practise these skills by repeating question 2 to find the length of:

a) a tea spoon

b) a carving knife



c) the length and width of a calculator

Activity 8 Answers

- | | | |
|---|----|--------------------------|
| 1 | a) | around 10 cm |
| | b) | around 20 cm |
| 2 | a) | no answer required |
| | b) | 7 cm, 71 mm |
| | c) | depends on your estimate |
| 3 | a) | around 14 cm |
| | b) | around 33 cm |
| | c) | around 15 cm, 8 cm |

You can also use the conversion factors to give meaning to metric length measurements.

Examples:

1.54 m in measurement terms means

- ‘1 metre and 54 cm’; **centimetres** are **hundredths** (two decimal places) **of a metre**
- ‘1 metre and 540 mm’; **millimetres** are **thousandths** (three decimal places) **of a metre** and $\frac{54}{100} = \frac{540}{1000}$.

5.8 km means

- ‘5.800 km’ or ‘5 km and 800 m’; **metres** are **thousandths of a kilometre**.

**Activity 9**

1 Change the following lengths to the given units:

- a) 1 500 mm to m _____
- b) 180 cm to m _____
- c) 1.36 m to cm _____
- d) 1.36 m to mm _____
- e) 2378 m to km _____
- f) 10 900 mm to m _____

2 Give the meaning of each metric length:

- a) 12.450 km means ____ km and ____ m
- b) 8.6 cm means ____ cm and ____ mm
- c) 8.6 m means ____ m and ____ cm
or ____ m and ____ mm
- d) 7.02 km means ____ km and ____ m

Activity 9 Answers

- | | | | |
|---|-------------|---|--------------------|
| 1 | a) 1.5 m | 2 | a) 12 km and 450 m |
| | b) 1.80 m | | b) 8 cm and 6 mm |
| | c) 136 cm | | c) 8 m and 60 cm |
| | d) 1360 mm | | or 8 m and 600 mm |
| | e) 2.378 km | | d) 7 km and 20 m |
| | f) 10.9 m | | |

Mass

The conversion factors for mass are similar to the units for length.



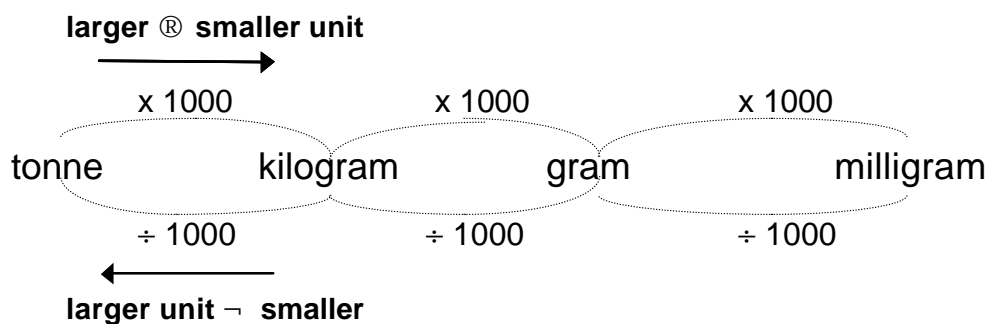
The common unit of **mass** is the **kilogram (kg)** but the **gram (g)** and the **tonne (t)** are also used.

Examples:

- there are 1000 g in 1 kg and 1000 kg in 1 tonne
- the mass of a car is around 1 tonne
- you might buy 250 g of ham at a delicatessen

The **milligram (mg)** is used for very small masses e.g. chemicals in prescribed drugs may be in amounts of 5 or 10 mg.

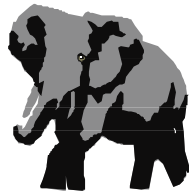
Conversion rules for mass:



**Activity 10**

1 Circle the most likely unit of mass for each of the objects given:

- | | | | | |
|----|---|-------|----|------|
| a) | a person | tonne | kg | gram |
| b) | marker pen | tonne | kg | gram |
| c) | bowling ball | tonne | kg | gram |
| d) | elephant | tonne | kg | gram |
| e) | glass of water | tonne | kg | gram |
| f) | semi-trailer truck not loaded | tonne | kg | gram |
| g) | a box containing 26 encyclopaedia volumes | tonne | kg | gram |



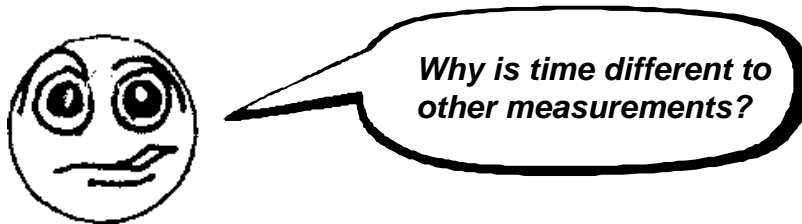
2 Give an estimate of the mass of each of the items in question 1.

3 Change to the given mass units:

- | | | |
|----|--------------|----------|
| a) | 2.2 kg to | _____ g |
| b) | 41 500 kg to | _____ t |
| c) | 0.849 t to | _____ kg |
| d) | 5305 gm to | _____ kg |
| e) | 125 gm to | _____ kg |

Activity 10 Answers

- | | | | |
|---|---|---|---|
| 1 | a) kg
b) g
c) kg
d) t
e) g
f) t
g) kg | 2 | There are no right answers for these, some possibilities are:
a) 50-80 kg
b) about 100 kg
c) about 5 kg
d) 1-2 t
e) about 300 g
f) 2-4 t
g) about 100 kg |
| | | 3 | a) 2200 g
b) 41.5 t
c) 849 kg
d) 5.305 kg
e) 0.125 kg |

Time

Time is not a metric measurement.

Our time measurements are based on rotations of the Earth and the Earth's moon.



Time is measured in **seconds, minutes, hours, days and years.**

Sometimes **milliseconds** are used in science, in engineering and for timing sporting performances.

Conversion factors for time are:

1000 milliseconds in 1 second

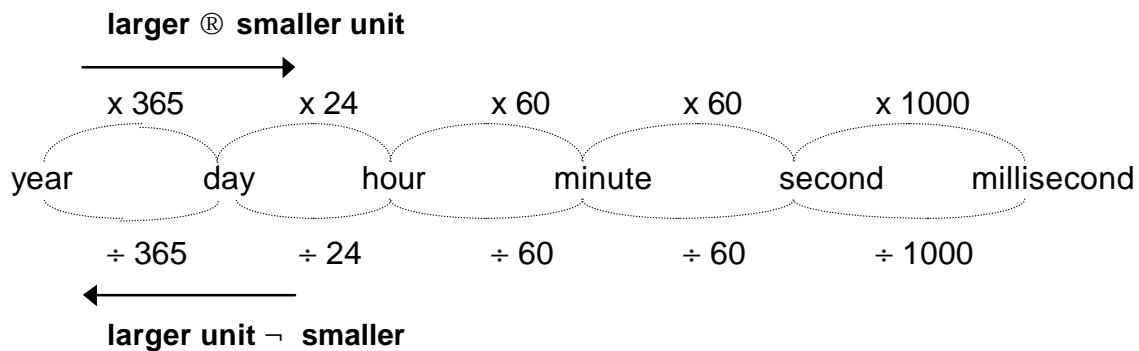
60 seconds in 1 minute

60 minutes in 1 hour

24 hours in 1 day

365 days in 1 year (366 days in a leap year)

100 years in 1 century



Each 24-hour day is divided into two lots of 12 hours, **am** and **pm**.

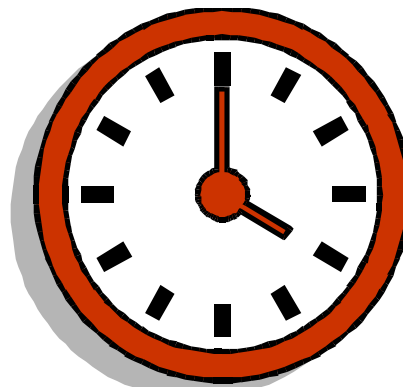
From 12 am (mid-night) to 11.59 am is **morning** or **am**.

From 12 pm (noon) to 11.59 pm is **afternoon** or **pm**.

You use a clock (analog instrument) to tell the time but need to add am or pm in situations like time of arrival and departure or appointment times.



small hand takes 1 hour to move from 1 to 2



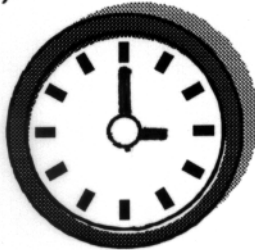
large hand takes 5 minutes to move from 12 to 1

- each large division (from 1 to 2) on a clockface represents 1 hour for the short hand or 5 minutes for the long hand.
- each small division represents 12 minutes for the short hand or 1 minute for the long hand.

**Activity 11**

1 Read the times on the clock faces shown:

a)



b)



c)



d)



e)



f)

**Activity 11 Answers**

a) 3:00

b) 12:30

c) 7:00

d) 8:30

e) 5:10

f) 10:45

Digital clocks give the time in hours and minutes in number form:

eg. 01 : 36 is read as one thirty six; it means 36 minutes after 1 o'clock - again we need to add am or pm if necessary but some digital clocks will tell us this.

10 : 04 is read as ten zero four; it means 4 minutes after 10 o'clock.



When calculating with **time** you need to remember that this is **not a decimal system**. When you change hours to minutes and minutes to seconds, you must multiply by 60. If you want to +, -, x or ÷ time you must remember different conversions apply.



Activity 12

- 1 Give these digital times in hours and minutes past the hour:
 - a) 2 : 17 (3 : 00) b) 12 : 10 (1 : 00)
 - c) 8 : 58 (9 : 00) d) 5 : 45 (6 : 00)
 - e) 10 : 06 (11 : 00)

- 2 How long (in minutes) before the times given in question 1 become the times shown in brackets?
 e.g. a) for 2 : 17 to become 3 : 00, 43 minutes need to pass
 (17 + 43 = 60 mins or 1 hr)

- 3 How long is taken on each of these jobs:
 - a) started at 9.10 am, finished at 10.30 am?
 - b) started at 7.30 am, finished at 11.12 am?
 - c) started at 12.15 pm, finished at 2.48 pm?
 - d) started at 10.55 pm, finished at 2.36 pm?

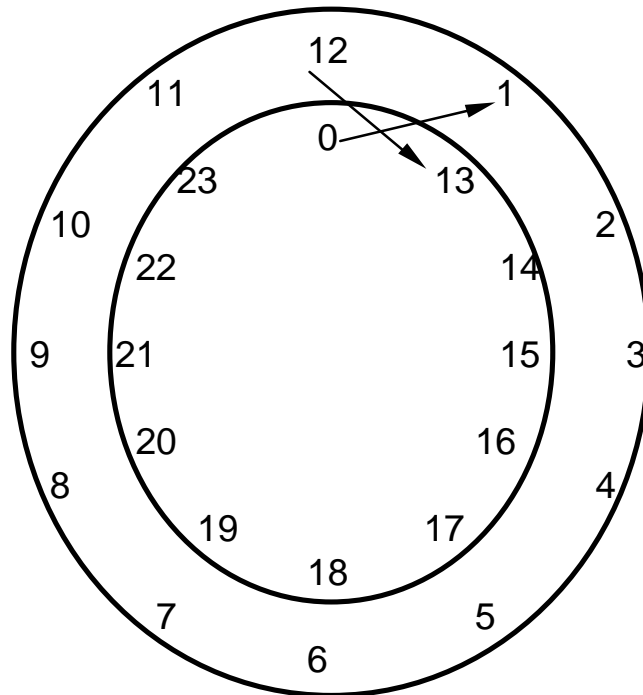
Activity 12 Answers

- | | | | |
|---|--|---|--|
| 1 | a) 17 mins past 2 o'clock
b) 10 mins past 12 o'clock
c) 58 mins past 8 o'clock
d) 45 mins past 5 o'clock
e) 6 mins past 10 o'clock | 3 | a) 1 hr 20 min
b) 3 hrs 42 min
c) 2 hrs 33 min
d) 15 hrs 41 min |
| 2 | a) 43 mins
b) 50 mins
c) 2 mins
d) 15 mins
e) 54 mins | | |

24 hour time

A day is made up of 24 hours, so the hour hand of a clock makes two complete revolutions in 1 day.

A 24-hour clock could look like this:



Many industries, such as travel and hospitality, management, etc. now use 24-hour time so that there is no confusion over am or pm.



Features of **24-hour time**:

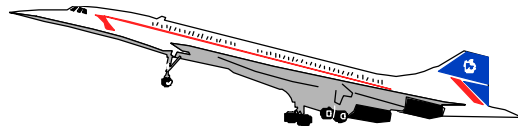
- the times **between 12 am and 1 am** (on the 12 hour clock) are called **zero hours** on the 24-hour clock eg. 12 : 35 am is 0035;
- for the **hours from 1 am to 12 pm** (noon) you use the numbers **1 to 12** eg. 9 : 45 am becomes 0945;
- for the **hours from 12 pm to 12 am** (noon to midnight) you use the numbers **13 to 24** eg. 8 : 20 pm becomes 2020 ($8 + 12 = 20$)

**Activity 13**

- 1 Convert these 12-hour and 24-hour times:

12-hour time	24-hour time
a) 2 : 00 pm	_____
b) 5 : 40 am	_____
c) _____	0050
d) _____	1525
e) _____	0924
f) 6 : 12 pm	_____
g) _____	2110

- 2 A plane leaves Sydney at 1035 and arrives at Bali at 1842 (Sydney time). How long did the trip take?
- 3 A flight takes $13\frac{1}{2}$ hours. If it leaves at 0845, when will it arrive?



- 4 On a time sheet an employee started the day at 8 : 10 am and finished the day at 5 : 50 pm. How long did she work if she had 45 mins out for lunch?

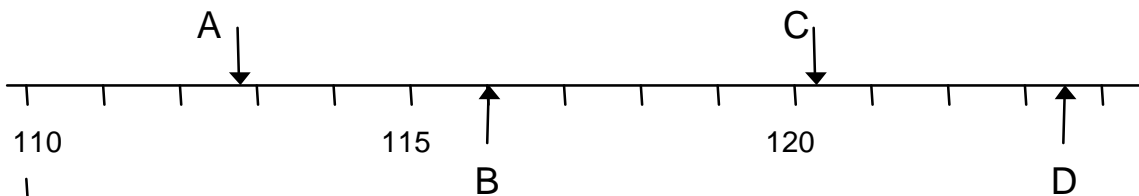
Activity 13 Answers

- | | | | | |
|---|----|----------|---|------------------|
| 1 | a) | 1400 | 2 | 8 hr 7 min |
| | b) | 0540 | 3 | 2215 or 10:15 pm |
| | c) | 12:50 am | 4 | 8 hr 55 min |
| | d) | 3:25 pm | | |
| | e) | 9:24 am | | |
| | f) | 1812 | | |
| | g) | 9:10 pm | | |



Test yourself on this skills unit

- 1 Give the measurements shown at the arrows (↓) on the scale:



(You will need to use your estimation skills for these)

- 2 Estimate, then measure, the dimensions of:
- this sheet of paper
 - a house brick
- 3 Give the meaning of these metric measurements:
- 10.422 kg means ___ kg ___ g
 - 0.75 km means ___ km ___ m
 - 2.9 L means ___ L ___ mL
 - 5.06 m means ___ m ___ cm
or ___ m ___ mm
- 4 Five laps of an athletic track, 400 m in length, is a distance of _____ m or _____ km.
- 5 Complete:
- $\frac{1}{5}$ km is _____ m
 - $\frac{1}{4}$ kg is _____ g
 - $\frac{1}{10}$ L is _____ mL



- 6 Give, in 12-hour and 24-hour time, the time:
- a) 50 minutes after 9 : 15 am
 - b) 1 hour 15 minutes after 11 : 50 pm
 - c) 2 hours 40 minutes after 10 : 25 am
- 7 You work for 8 hours and 15 minutes each day for 5 days. What was the total time you worked for this week?
- 8 Your train leaves Melbourne at 6 : 40 am and arrives in Sydney 10 hours and 50 minutes later. What is its Sydney arrival time?

Test yourself on this unit Answers

- 1 A 112.7
 B 116
 C 120.3
 D 123.5
- 2 a) estimates and measurements
 will depend on paper and brick
 size
- 3 a) 10 kg 422 g
 b) 0 km 750 m
 c) 2L 900 mL
 d) 5 m 6 cm or 5 m 60 mm
- 4 2000 m or 2 km
- 5 a) 200 m
 b) 250 g
 c) 100 mL
- 6 a) 10:05 am or 1005
 b) 1:05 am or 0105
 c) 1:05 pm or 1305
- 7 41 hr 15 min
- 8 5:30 pm or 1730